Central Station Resources Scenario Overview

- **Central Station Resources**
- **Plan Specifics**
  - Average Annual Peak Demand Growth at 1.21%
  - Average Annual Energy Sales Growth at 1.29%
- **Alternatives Considered**
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only
- **Alternatives Screened Out**
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
## Central Station Resources Scenario Expansion Plan Results

### 2006 to 2015

- **Capacity Additions**
  - CT: 1,440 mW
  - CC: 0 mW
  - PC: 2,000 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 0 mW
  - **Total**: 3,440 mW

- **Demand Growth**: 1.17%
- **Reserve Margin**: 15.26%

- **Plan Costs**
  - NPV Utility Cost: $32,073.0 M
  - NPV Emissions: $3,385.6 M
  - NPV CO2: $0.00 M

### 2006 to 2025

- **Capacity Additions**
  - CT: 1,760 mW
  - CC: 500 mW
  - PC: 9,000 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 0 mW
  - **Total**: 11,260 mW

- **Demand Growth**: 1.21%
- **Reserve Margin**: 15.52%

- **Plan Costs**
  - NPV Utility Cost: $56,716.9 M
  - NPV Emissions: $5,602.8 M
  - NPV CO2: $0.00 M

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- **Coal**: 58%
- **CT**: 42%
- **CC**: 2%

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**Energy Business Solutions Proprietary and Confidential**
### Central Station Resources Scenario Expansion Plan Schedule

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Central Station Resources Scenario
High Load Growth Sensitivity Overview

- Central Station Resources with High Load Growth

- Plan Specifics
  - Average Annual Peak Demand Growth at 1.16%
  - Average Annual Energy Sales Growth at 1.69%

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Central Station Resources Scenario
High Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 2,240 mW
    - CC: 1,500 mW
    - PC: 3,000 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - Total: 6,740 mW
  - **Demand Growth**: 2.02%
  - **Reserve Margin**: 15.26%
  - **Plan Costs**
    - NPV Utility Cost: $35,512.2 M
    - NPV Emissions: $3,431.0 M
    - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 3,040 mW
    - CC: 2,000 mW
    - PC: 10,000 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - Total: 15,040 mW
  - **Demand Growth**: 1.61%
  - **Reserve Margin**: 15.63%
  - **Plan Costs**
    - NPV Utility Cost: $64,116.8 M
    - NPV Emissions: $5,720.8 M
    - NPV CO2: $0.0 M

Energy Business Solutions
Proprietary and Confidential
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Central Station Resources Scenario
Low Load Growth Sensitivity Overview

- Central Station Resources with Low Load Growth

- Plan Specifics
  - Average Annual Peak Demand Growth at 0.76%
  - Average Annual Energy Sales Growth at 0.84%

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Central Station Resources Scenario
Low Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 160 mW
    - CC: 0 mW
    - PC: 500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - Total: 660 mW
- **Demand Growth**: 0.21%
- **Reserve Margin**: 17.28%
- **Plan Costs**
  - NPV Utility Cost: $28,873.2 M
  - NPV Emissions: $3,356.5 M
  - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 640 mW
    - CC: 500 mW
    - PC: 6,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - Total: 7,640 mW
- **Demand Growth**: 0.76%
- **Reserve Margin**: 15.95%
- **Plan Costs**
  - NPV Utility Cost: $49,811.6 M
  - NPV Emissions: $5,470.6 M
  - NPV CO2: $0.0 M

Energy Business Solutions
Proprietary and Confidential
### Central Station Resources Scenario

#### Low Load Growth Sensitivity

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Central Station Resources Scenario
Reduced Import Sensitivity Overview

- Central Station Resources with Reduced Import Capability

- Plan Specifics
  - Base Load Growth
  - Reduced Import Capacity into MECS to 1,650 mW to account for energy flows to Ontario

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Central Station Resources Scenario
Reduced Import Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 1,440 mW
    - CC: 0 mW
    - PC: 2,000 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - Total: 3,440 mW
  - **Demand Growth**: 1.17%
  - **Reserve Margin**: 15.26%
  - **Plan Costs**
    - NPV Utility Cost: $32,169.2 M
    - NPV Emissions: $3,373.6 M
    - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 2,720 mW
    - CC: 1,000 mW
    - PC: 7,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - Total: 11,220 mW
  - **Demand Growth**: 1.21%
  - **Reserve Margin**: 15.40%
  - **Plan Costs**
    - NPV Utility Cost: $57,004.8 M
    - NPV Emissions: $5,492.4 M
    - NPV CO2: $0.0 M

Pies demonstrating the share of energy sources:

- **2006 to 2015**: CT 42%, CC 9%, Coal 58%
- **2006 to 2025**: CT 24%, CC 9%, Coal 67%
## Central Station Resources Scenario

**Reduced Import Sensitivity**

**Expansion Plan Schedule**

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Central Station Resources Scenario
Expanded Transmission Sensitivity Overview

- Central Station Resources with Expanded Transmission

- Plan Specifics
  - Base Load Growth
  - Increase Transmission Capacity into ITC by 2,500 mW
  - Cost of Transmission Upgrades $800M ($640M charged to Michigan)
  - Reduce Minimum Reserve Margin Constraint to 12%

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Central Station Resources Scenario
Expanded Transmission Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 160 mW
    - CC: 500 mW
    - PC: 2,000 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - Total: 2,660 mW

- Demand Growth: 1.17%
- Reserve Margin: 12.53%
- **Plan Costs**
  - NPV Utility Cost: $32,329.1 M
  - NPV Emissions: $3,400.3 M
  - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 800 mW
    - CC: 1,000 mW
    - PC: 8,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - Total: 10,300 mW

- Demand Growth: 1.21%
- Reserve Margin: 12.56%
- **Plan Costs**
  - NPV Utility Cost: $57,085.5 M
  - NPV Emissions: $5,627.2 M
  - NPV CO2: $0.0 M

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Energy Business Solutions
Proprietary and Confidential
## Central Station Resources Scenario

### Expanded Transmission Sensitivity

#### Expansion Plan Schedule

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Energy Business Solutions
Proprietary and Confidential
Emissions (Carbon Case) Scenario Overview

- Emissions Case

- Plan Specifics
  - Base Load Growth
  - Carbon Tax
    - $10/Ton in 2010
    - Grows to $30/Ton in 2018

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only
  - Nuclear

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - CFB – except UP
Emissions (Carbon Case) Scenario Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 1,440 mW
    - CC: 500 mW
    - PC: 1,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - **Total**: 3,440 mW
  - **Demand Growth**: 1.17%
  - **Reserve Margin**: 15.26%
  - **Plan Costs**
    - NPV Utility Cost: $36,956.6 M
    - NPV Emissions: $8,150.5 M
    - NPV CO2: $4,688.2 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 1,760 mW
    - CC: 1,000 mW
    - PC: 2,000 mW
    - Nuclear: 6,000 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - **Total**: 10,760 mW
  - **Demand Growth**: 1.21%
  - **Reserve Margin**: 16.04%
  - **Plan Costs**
    - NPV Utility Cost: $70,752.2 M
    - NPV Emissions: $18,991.7 M
    - NPV CO2: $13,358.9 M
## Emissions (Carbon Case) Scenario Expansion Plan Schedule

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**Note:** This table represents the expansion plan schedule for different energy sources and years.
Emissions (Carbon Case) Scenario
High Load Growth Sensitivity Overview

- Emissions with High Load Growth
- Plan Specifics
  - High Load Growth
  - Carbon Tax
    - $10/Ton in 2010
    - Grows to $30/Ton in 2018

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only
  - Nuclear

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - CFB – except UP
Emissions (Carbon Case) Scenario
High Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 1,760 mW
    - CC: 2,000 mW
    - PC: 3,000 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - Total: 6,760 mW
  - **Demand Growth**: 2.02%
  - **Reserve Margin**: 15.33%

- **Plan Costs**
  - NPV Utility Cost: $40,832.7 M
  - NPV Emissions: $8,523.0 M
  - NPV CO2: $5,006.8 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 2,240 mW
    - CC: 2,000 mW
    - PC: 4,000 mW
    - Nuclear: 6,000 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - Total: 14,240 mW
  - **Demand Growth**: 1.61%
  - **Reserve Margin**: 15.26%

- **Plan Costs**
  - NPV Utility Cost: $79,492.7 M
  - NPV Emissions: $20,788.7 M
  - NPV CO2: $14,989.6 M
# Emissions (Carbon Case) Scenario
## High Load Growth Sensitivity
### Expansion Plan Schedule

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*Notes:*
- CT, CC, COAL, FFB, and NUKE refer to different energy sources.
- METC and ITC denote specific facilities or operational parameters.
- The numbers indicate the planned schedule for expansion or use in given years.
Emissions (Carbon Case) Scenario
Low Load Growth Sensitivity Overview

- Emissions Low Load Case

- Plan Specifics
  - Low Load Growth
  - Carbon Tax
    - $10/Ton in 2010
    - Grows to $30/Ton in 2018

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only
  - Nuclear

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - CFB – except UP
Emissions (Carbon Case) Scenario
Low Load Growth Sensitivity
Expansion Plan Results

- 2006 to 2015
  - Capacity Additions
    - CT 320 mW
    - CC 0 mW
    - PC 0 mW
    - Nuclear 0 mW
    - Renewable 0 mW
    - Energy Efficiency 0 mW
    - Total 320 mW
  - Demand Growth 0.21%
  - Reserve Margin 15.96%
  - Plan Costs
    - NPV Utility Cost $33,321.8 M
    - NPV Emissions $ 7,849.3 M
    - NPV CO2 $ 4,420.0 M

- 2006 to 2025
  - Capacity Additions
    - CT 480 mW
    - CC 0 mW
    - PC 1,000 mW
    - Nuclear 6,000 mW
    - Renewable 0 mW
    - Energy Efficiency 0 mW
    - Total 7,480 mW
  - Demand Growth 0.76%
  - Reserve Margin 17.69%
  - Plan Costs
    - NPV Utility Cost $62,254.7 M
    - NPV Emissions $17,817.7 M
    - NPV CO2 $12,293.9 M
### Emissions (Carbon Case) Scenario
Low Load Growth Sensitivity
Expansion Plan Schedule

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Emissions (Carbon Case) Scenario
Energy Efficiency Sensitivity Overview

- Emissions with Energy Efficiency

- Plan Specifics
  - Base Load Growth
  - Carbon Tax
    - $10/Ton in 2010
    - Grows to $30/Ton in 2018
  - Energy Efficiency added to existing resource mix:
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only
  - Nuclear

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - CFB – except UP
Emissions (Carbon Case) Scenario
Energy Efficiency Sensitivity
Expansion Plan Results

2006 to 2015
Capacity Additions
- CT 640 mW
- CC 0 mW
- PC 1,000 mW
- Nuclear 0 mW
- Renewable 0 mW
- Energy Efficiency 1,609 mW
Total 3,249 mW

Demand Growth 0.46%
Reserve Margin 16.09%

Plan Costs
- NPV Utility Cost $36,189.0 M
- NPV Emissions $8,005.9 M
- NPV CO2 $4,558.8 M

2006 to 2025
Capacity Additions
- CT 960 mW
- CC 0 mW
- PC 1,500 mW
- Nuclear 5,000 mW
- Renewable 0 mW
- Energy Efficiency 2,801 mW
Total 10,261 mW

Demand Growth 0.68%
Reserve Margin 16.53%

Plan Costs
- NPV Utility Cost $66,707.5 M
- NPV Emissions $18,347.7 M
- NPV CO2 $12,779.8 M

Energy Business Solutions
Proprietary and Confidential
## Emissions (Carbon Case) Scenario

### Energy Efficiency Sensitivity

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Emissions (Carbon Case) Scenario
Energy Efficiency and Renewables Sensitivity
Overview

- Emissions with Energy Efficiency and Renewables

- Plan Specifics
  - Base Load Growth
  - Carbon Tax
    - $10/Ton in 2010
    - Grows to $30/Ton in 2018
  - Energy Efficiency and Renewables added to existing resource mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only
  - Nuclear

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - CFB – except UP
Emissions (Carbon Case) Scenario
Energy Efficiency and Renewables Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 320 mW
    - CC: 0 mW
    - PC: 500 mW
    - Nuclear: 0 mW
    - Renewable: 1,609 mW
    - Energy Efficiency: 500 mW
    - **Total**: 3,026 mW
  - **Demand Growth**: 0.46%
  - **Reserve Margin**: 16.25%
  - **Plan Costs**
    - NPV Utility Cost: $36,098.0 M
    - NPV Emissions: $7,870.5 M
    - NPV CO2: $4,439.5 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 480 mW
    - CC: 500 mW
    - PC: 500 mW
    - Nuclear: 5,000 mW
    - Renewable: 798 mW
    - Energy Efficiency: 2,801 mW
    - **Total**: 10,079 mW
  - **Demand Growth**: 0.68%
  - **Reserve Margin**: 16.89%
  - **Plan Costs**
    - NPV Utility Cost: $65,594.5 M
    - NPV Emissions: $17,618.7 M
    - NPV CO2: $12,108.3 M
### Emissions (Carbon Case) Scenario

#### Energy Efficiency and Renewables Sensitivity

#### Expansion Plan Schedule

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Renewable Generation Scenario Overview

- Renewable Generation Resources

- Plan Specifics
  - Base Load Growth
  - Renewable Resources “Hard Wired” into future generation mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Renewable Generation Scenario Expansion Plan Results

2006 to 2015
Capacity Additions
- CT: 1,280 mW
- CC: 0 mW
- PC: 1,500 mW
- Nuclear: 0 mW
- Renewable: 599 mW
- Energy Efficiency: 0 mW
Total: 3,379 mW

- Demand Growth: 1.17%
- Reserve Margin: 15.97%

Plan Costs
- NPV Utility Cost: $36,506.9 M
- NPV Emissions: $3,377.2 M
- NPV CO2: $0.0 M

2006 to 2025
Capacity Additions
- CT: 1,920 mW
- CC: 500 mW
- PC: 8,000 mW
- Nuclear: 0 mW
- Renewable: 798 mW
- Energy Efficiency: 0 mW
Total: 11,218 mW

- Demand Growth: 1.21%
- Reserve Margin: 16.28%

Plan Costs
- NPV Utility Cost: $57,496.7 M
- NPV Emissions: $5,540.9 M
- NPV CO2: $0.0 M
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Renewable Generation Scenario
High Load Growth Sensitivity Overview

- Renewable Generation Resources with High Load Growth

- Plan Specifics
  - High Load Growth
  - Renewable Resources “Hard Wired” into future generation mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
## Renewable Generation Scenario
### High Load Growth Sensitivity
### Expansion Plan Results

#### 2006 to 2015
- **Capacity Additions**
  - CT: 1,600 mW
  - CC: 1,500 mW
  - PC: 3,000 mW
  - Nuclear: 0 mW
  - Renewable: 599 mW
  - Energy Efficiency: 0 mW
- **Total**: 6,699 mW
- **Demand Growth**: 2.02%
- **Reserve Margin**: 15.98%
- **Plan Costs**
  - NPV Utility Cost: $35,929.4 M
  - NPV Emissions: $3,424.3 M
  - NPV CO2: $0.0 M

#### 2006 to 2025
- **Capacity Additions**
  - CT: 2,400 mW
  - CC: 2,000 mW
  - PC: 9,500 mW
  - Nuclear: 0 mW
  - Renewable: 798 mW
  - Energy Efficiency: 0 mW
- **Total**: 14,698 mW
- **Demand Growth**: 1.61%
- **Reserve Margin**: 15.48%
- **Plan Costs**
  - NPV Utility Cost: $64,758.6 M
  - NPV Emissions: $5,687.4 M
  - NPV CO2: $0.0 M
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Renewable Generation Scenario
Low Load Growth Sensitivity Overview

- Renewable Generation Resources with Low Load Growth

- Plan Specifics
  - Low Load Growth
  - Renewable Resources “Hard Wired” into future generation mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Renewable Generation Scenario
Low Load Growth Sensitivity
Expansion Plan Results

2006 to 2015
Capacity Additions
- CT 0 mW
- CC 0 mW
- PC 0 mW
- Nuclear 0 mW
- Renewable 599 mW
- Energy Efficiency 0 mW
- Total 599 mW

- Demand Growth 0.21 %
- Reserve Margin 18.07 %
- Plan Costs
  - NPV Utility Cost $29,436.3 M
  - NPV Emissions $ 3,348.2 M
  - NPV CO2 $ 0.0 M

2006 to 2025
Capacity Additions
- CT 1,440 mW
- CC 0 mW
- PC 5,000 mW
- Nuclear 0 mW
- Renewable 798 mW
- Energy Efficiency 0 mW
- Total 7,238 mW

- Demand Growth 0.76 %
- Reserve Margin 15.55 %
- Plan Costs
  - NPV Utility Cost $50,797.8 M
  - NPV Emissions $ 5,382.1 M
  - NPV CO2 $ 0.0 M

Renewables 100%

Energy Business Solutions
Proprietary and Confidential
## Renewable Generation Scenario
### Low Load Growth Sensitivity
### Expansion Plan Schedule

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Energy Efficiency Scenario Overview

- Energy Efficiency

- Plan Specifics
  - Base Load Growth starting point
  - Energy Efficiency Added to existing resource mix:
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency Scenario Expansion Plan Results

2006 to 2015
- Capacity Additions
  - CT: 640 mW
  - CC: 0 mW
  - PC: 1,000 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 1,609 mW
- Total: 3,249 mW

- Demand Growth: 0.46%
- Reserve Margin: 16.09%

- Plan Costs
  - NPV Utility Cost: $31,510.1 M
  - NPV Emissions: $3,307.1 M
  - NPV CO2: $0.0 M

2006 to 2025
- Capacity Additions
  - CT: 1,280 mW
  - CC: 0 mW
  - PC: 6,500 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 2,801 mW
- Total: 10,581 mW

- Demand Growth: 0.68%
- Reserve Margin: 15.73%

- Plan Costs
  - NPV Utility Cost: $53,794.5 M
  - NPV Emissions: $5,494.7 M
  - NPV CO2: $0.0 M
## Energy Efficiency Scenario Expansion Plan Schedule

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Energy Efficiency Scenario
High Load Growth Sensitivity Overview

- Energy Efficiency with High Load Growth

- Plan Specifics
  - High Load Growth starting point
  - Energy Efficiency Added to existing resource mix:
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency Scenario
High Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 960 mW
    - CC: 1,500 mW
    - PC: 2,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 1,609 mW
    - Total: 6,569 mW
  - **Demand Growth**: 1.37 %
  - **Reserve Margin**: 16.08 %
  - **Plan Costs**
    - NPV Utility Cost: $34,918.3 M
    - NPV Emissions: $3,421.6 M
    - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 1,440 mW
    - CC: 2,000 mW
    - PC: 8,000 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 2,801 mW
    - Total: 14,241 mW
  - **Demand Growth**: 1.13 %
  - **Reserve Margin**: 15.45 %
  - **Plan Costs**
    - NPV Utility Cost: $61,040.0 M
    - NPV Emissions: $5,644.4 M
    - NPV CO2: $0.0 M
## Energy Efficiency Scenario

### High Load Growth Sensitivity

#### Expansion Plan Schedule

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Energy Efficiency Scenario
Low Load Growth Sensitivity Overview

- Energy Efficiency with Low Load Growth

- Plan Specifics
  - Low Load Growth starting point
  - Energy Efficiency Added to existing resource mix
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency Scenario
Low Load Growth Sensitivity
Expansion Plan Results

2006 to 2015
- Capacity Additions
  - CT: 0 mW
  - CC: 0 mW
  - PC: 0 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 1,609 mW
  - Total: 1,609 mW
- Demand Growth: -0.57%
- Reserve Margin: 23.11%
- Plan Costs
  - NPV Utility Cost: $28,638.7 M
  - NPV Emissions: $3,350.5 M
  - NPV CO2: $0.0 M

2006 to 2025
- Capacity Additions
  - CT: 480 mW
  - CC: 0 mW
  - PC: 3,500 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 2,801 mW
  - Total: 6,781 mW
- Demand Growth: 0.17%
- Reserve Margin: 15.53%
- Plan Costs
  - NPV Utility Cost: $47,384.1 M
  - NPV Emissions: $5,348.2 M
  - NPV CO2: $0.0 M
## Energy Efficiency Scenario
### Low Load Growth Sensitivity
#### Expansion Plan Schedule

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Note: The table represents the expansion plan schedule with specific units for each year from 2006 to 2025.
Energy Efficiency Scenario
Reduced EE Penetration Sensitivity Overview

- Energy Efficiency with Base Load Growth

- Plan Specifics
  - Base Load Growth starting point
  - Energy Efficiency Added to existing resource mix
    - 1,920 mW Peak Demand reduction
    - 8,327 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency Scenario
Reduced EE Penetration Sensitivity
Expansion Plan Results

- 2006 to 2015
  - Capacity Additions
    - CT: 640 mW
    - CC: 0 mW
    - PC: 1,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 1,127 mW
  - Total: 3,267 mW
- Demand Growth: 0.67%
- Reserve Margin: 15.69%
- Plan Costs
  - NPV Utility Cost: $32,208.7 M
  - NPV Emissions: $3,379.9 M
  - NPV CO2: $0.0 M

- 2006 to 2025
  - Capacity Additions
    - CT: 1,280 mW
    - CC: 0 mW
    - PC: 7,500 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 1,920 mW
  - Total: 10,700 mW
- Demand Growth: 0.85%
- Reserve Margin: 15.36%
- Plan Costs
  - NPV Utility Cost: $55,765.2 M
  - NPV Emissions: $5,542.4 M
  - NPV CO2: $0.0 M
## Energy Efficiency Scenario
### Reduced EE Penetration Sensitivity

#### Expansion Plan Schedule

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Energy Efficiency and Renewables Scenario Overview

- Energy Efficiency with Renewable Generation Resources

- Plan Specifics
  - Base Load Growth starting point
  - Energy Efficiency and Renewables added to existing resource mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency and Renewables Scenario
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 320 mW
    - CC: 0 mW
    - PC: 500 mW
    - Nuclear: 0 mW
    - Renewable: 599 mW
    - Energy Efficiency: 1,609 mW
  - **Total**: 3,028 mW

- **Demand Growth**: 0.46%
- **Reserve Margin**: 16.25%

- **Plan Costs**
  - NPV Utility Cost: $31,998.1 M
  - NPV Emissions: $3,354.9 M
  - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 1,760 mW
    - CC: 0 mW
    - PC: 5,000 mW
    - Nuclear: 0 mW
    - Renewable: 798 mW
    - Energy Efficiency: 2,801 mW
  - **Total**: 10,359 mW

- **Demand Growth**: 0.68%
- **Reserve Margin**: 15.95%

- **Plan Costs**
  - NPV Utility Cost: $54,623.2 M
  - NPV Emissions: $5,411.1 M
  - NPV CO2: $0.0 M
## Energy Efficiency and Renewables Scenario
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Energy Efficiency and Renewables Scenario
High Load Growth Sensitivity Overview

- Energy Efficiency with Renewable Generation Resources

- Plan Specifics
  - High Load Growth starting point
  - Energy Efficiency and Renewables added to existing resource mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
    - 2,801 mW Peak Demand reduction
    - 14,430 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency and Renewables Scenario
High Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 480 mW
    - CC: 1,500 mW
    - PC: 2,000 mW
    - Nuclear: 0 mW
    - Renewable: 599 mW
    - Energy Efficiency: 1,609 mW
    - Total: 6,188 mW
  - **Demand Growth**: 1.37%
  - **Reserve Margin**: 15.69%
  - **Plan Costs**
    - NPV Utility Cost: $35,354.4 M
    - NPV Emissions: $3,405.9 M
    - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 800 mW
    - CC: 2,000 mW
    - PC: 7,500 mW
    - Nuclear: 0 mW
    - Renewable: 798 mW
    - Energy Efficiency: 2,801 mW
    - Total: 13,899 mW
  - **Demand Growth**: 1.13%
  - **Reserve Margin**: 15.28%
  - **Plan Costs**
    - NPV Utility Cost: $61,780.4 M
    - NPV Emissions: $5,598.0 M
    - NPV CO2: $0.0 M
## Energy Efficiency and Renewables Scenario
### High Load Growth Sensitivity
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Energy Efficiency and Renewables Scenario
Low Load Growth Sensitivity Overview

- Energy Efficiency with Renewable Generation Resources

- Plan Specifics
  - Low Load Growth starting point
  - Energy Efficiency and Renewables added to existing resource mix:
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  - 160 mW CT – all regions
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  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
# Energy Efficiency and Renewables Scenario
## Low Load Growth Sensitivity
### Expansion Plan Results

#### 2006 to 2015
- **Capacity Additions**
  - CT: 0 mW
  - CC: 0 mW
  - PC: 0 mW
  - Nuclear: 0 mW
  - Renewable: 599 mW
  - Energy Efficiency: 1,609 mW
- **Total**: 2,208 mW

- **Demand Growth**: -0.57%
- **Reserve Margin**: 26.70%
- **Plan Costs**
  - NPV Utility Cost: $29,246.5 M
  - NPV Emissions: $3,346.6 M
  - NPV CO2: $0.0 M

#### 2006 to 2025
- **Capacity Additions**
  - CT: 480 mW
  - CC: 0 mW
  - PC: 2,500 mW
  - Nuclear: 0 mW
  - Renewable: 798 mW
  - Energy Efficiency: 2,801 mW
- **Total**: 6,579 mW

- **Demand Growth**: 0.17%
- **Reserve Margin**: 15.86%
- **Plan Costs**
  - NPV Utility Cost: $48,407.9 M
  - NPV Emissions: $5,306.8 M
  - NPV CO2: $0.0 M

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![Energy Business Solutions Pie Chart](image)

**Coal**: 38%
**Renewables**: 27%
**Energy Efficiency**: 43%
## Energy Efficiency and Renewables Scenario
### Low Load Growth Sensitivity
#### Expansion Plan Schedule

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- **Energy Business Solutions**
- **Proprietary and Confidential**
Energy Efficiency and Renewables Scenario
Reduced EE Penetration Sensitivity Overview

- Energy Efficiency with Renewable Generation Resources

- Plan Specifics
  - Base Load Growth starting point
  - Energy Efficiency and Renewables added to existing resource mix:
    - 1,354 mW of Renewable Resources
    - 798 mW Firm Renewable Capacity
    - 1,920 mW Peak Demand reduction
    - 8,327 gWh Energy Sales reductions
  - Central Station resource additions re-optimized

- Alternatives Considered
  - 160 mW CT – all regions
  - 500 mW CC – all regions
  - 500 mW PC – all regions
  - 150 mW CFB – UP only

- Alternatives Screened Out
  - IGCC
  - IGCC – PRB coal
  - Nuclear
  - CFB – except UP
Energy Efficiency and Renewables Scenario
Reduced EE Penetration Sensitivity
Expansion Plan Results

2006 to 2015
Capacity Additions
- CT: 160 mW
- CC: 0 mW
- PC: 1,500 mW
- Nuclear: 0 mW
- Renewable: 599 mW
- Energy Efficiency: 1,127 mW
Total: 3,386 mW

Demand Growth: 0.67%
Reserve Margin: 17.10%
Plan Costs
- NPV Utility Cost: $32,692.1 M
- NPV Emissions: $3,374.0 M
- NPV CO2: $0.0 M

2006 to 2025
Capacity Additions
- CT: 800 mW
- CC: 500 mW
- PC: 6,500 mW
- Nuclear: 0 mW
- Renewable: 798 mW
- Energy Efficiency: 1,920 mW
Total: 10,518 mW

Demand Growth: 0.85%
Reserve Margin: 15.70%
Plan Costs
- NPV Utility Cost: $56,546.1 M
- NPV Emissions: $5,504.4 M
- NPV CO2: $0.0 M
Energy Efficiency and Renewables Scenario
Reduced EE Penetration Sensitivity
Expansion Plan Schedule

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Combustion Turbines Only Scenario Overview

- Combustion Turbines Only
- Plan Specifics
  - Base Load Growth
- Alternatives Considered
  - 160 mW CT
- Alternatives Not Considered
  - CC
  - PC
  - CFB
  - IGCC
  - IGCC – PRB coal
  - Nuclear
Combustion Turbines Only Scenario Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 3,520 mW
    - CC: 0 mW
    - PC: 0 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - Total: 3,520 mW
  - Demand Growth: 1.17 %
  - Reserve Margin: 15.54 %
  - Plan Costs
    - NPV Utility Cost: $32,126.9 M
    - NPV Emissions: $3,354.5 M
    - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 11,200 mW
    - CC: 0 mW
    - PC: 0 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
  - Total: 11,200 mW
  - Demand Growth: 1.21 %
  - Reserve Margin: 15.34 %
  - Plan Costs
    - NPV Utility Cost: $58,987.6 M
    - NPV Emissions: $5,348.5 M
    - NPV CO2: $0.0 M
## Combustion Turbines Only Scenario Expansion Plan Schedule

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Combustion Turbines Only Scenario
High Load Growth Sensitivity Overview

- Combustion Turbines Only

- Plan Specifics
  - High Load Growth

- Alternatives Considered
  - 160 mW CT

- Alternatives Not Considered
  - CC
  - PC
  - CFB
  - IGCC
  - IGCC – PRB coal
  - Nuclear
Combustion Turbines Only Scenario
High Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
- **Capacity Additions**
  - CT: 6,720 mW
  - CC: 0 mW
  - PC: 0 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 0 mW
  - **Total**: 6,720 mW
- **Demand Growth**: 2.02 %
- **Reserve Margin**: 15.20 %
- **Plan Costs**
  - NPV Utility Cost: $35,630.2 M
  - NPV Emissions: $3,362.5 M
  - NPV CO2: $0.0 M

- **2006 to 2025**
- **Capacity Additions**
  - CT: 14,880 mW
  - CC: 0 mW
  - PC: 0 mW
  - Nuclear: 0 mW
  - Renewable: 0 mW
  - Energy Efficiency: 0 mW
  - **Total**: 14,880 mW
- **Demand Growth**: 1.61 %
- **Reserve Margin**: 15.18 %
- **Plan Costs**
  - NPV Utility Cost: $68,096.6 M
  - NPV Emissions: $5,410.1 M
  - NPV CO2: $0.0 M
## Combustion Turbines Only Scenario
### High Load Growth Sensitivity
#### Expansion Plan Schedule

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Combustion Turbines Only Scenario
Low Load Growth Sensitivity Overview

- Combustion Turbines Only
- Plan Specifics
  - Low Load Growth
- Alternatives Considered
  - 160 mW CT
- Alternatives Not Considered
  - CC
  - PC
  - CFB
  - IGCC
  - IGCC – PRB coal
  - Nuclear
Combustion Turbines Only Scenario
Low Load Growth Sensitivity
Expansion Plan Results

- **2006 to 2015**
  - **Capacity Additions**
    - CT: 320 mW
    - CC: 0 mW
    - PC: 0 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - **Total**: 320 mW
  - **Demand Growth**: 0.21%
  - **Reserve Margin**: 15.96%
- **Plan Costs**
  - NPV Utility Cost: $28,856.0 M
  - NPV Emissions: $3,354.0 M
  - NPV CO2: $0.0 M

- **2006 to 2025**
  - **Capacity Additions**
    - CT: 7,680 mW
    - CC: 0 mW
    - PC: 0 mW
    - Nuclear: 0 mW
    - Renewable: 0 mW
    - Energy Efficiency: 0 mW
    - **Total**: 7,680 mW
  - **Demand Growth**: 0.76%
  - **Reserve Margin**: 16.09%
- **Plan Costs**
  - NPV Utility Cost: $50,737.5 M
  - NPV Emissions: $5,308.7 M
  - NPV CO2: $0.0 M
## Combustion Turbines Only Scenario
### Low Load Growth Sensitivity
#### Expansion Plan Schedule

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### Summary Across Expansion Plans: 2006-2025

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<td>$47,384.1</td>
</tr>
<tr>
<td>EE Reduce Pen</td>
<td>10,700</td>
<td>1,280</td>
<td>0</td>
<td>7,500</td>
<td>0</td>
<td>0</td>
<td>1,920</td>
<td>15.36%</td>
<td>27,269</td>
<td>$55,765.2</td>
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<tr>
<td>EE &amp; Renew</td>
<td>10,359</td>
<td>1,760</td>
<td>0</td>
<td>5,000</td>
<td>0</td>
<td>798</td>
<td>2,801</td>
<td>15.95%</td>
<td>26,404</td>
<td>$54,623.2</td>
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<tr>
<td>EE&amp;R High Load</td>
<td>13,899</td>
<td>800</td>
<td>2,000</td>
<td>7,500</td>
<td>0</td>
<td>798</td>
<td>2,801</td>
<td>15.28%</td>
<td>29,320</td>
<td>$61,780.4</td>
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<td>480</td>
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<td>15.86%</td>
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<tr>
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<td>500</td>
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<td>1,920</td>
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<tr>
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<td>120</td>
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